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# RADIUM

EDITED BY

CHARLES H. VIOL, Ph. D.

AND

WILLIAM H. CAMERON, M. D.

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VOL. IV

DECEMBER, 1914

No. 3

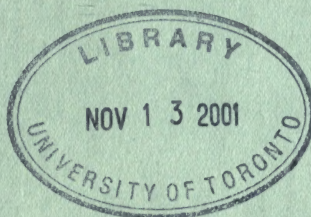
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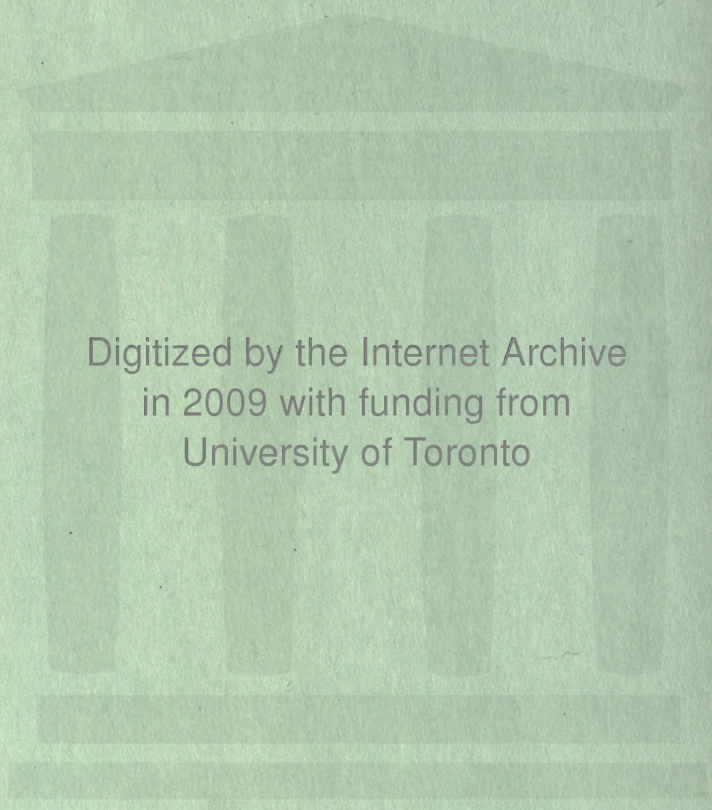
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A MONTHLY JOURNAL DEVOTED TO THE CHEMISTRY  
PHYSICS AND THERAPEUTICS OF RADIUM  
AND RADIO-ACTIVE SUBSTANCES



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# RADIUM

A MONTHLY JOURNAL DEVOTED TO THE CHEMISTRY, PHYSICS AND  
THERAPEUTICS OF RADIUM AND RADIO-ACTIVE SUBSTANCES.

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Edited and Published by Charles H. Viol, Ph. D. and William H. Cameron, M. D.,  
with the assistance of collaborators working in the fields of  
Radiochemistry, Radioactivity and Radiumtherapy.

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VOL. IV

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## RADIUM IN THE TREATMENT OF CANCER\*

WILLIAM H. CAMERON, M. D.

We will discuss the application of radium in dermatology and cancer, and as it is not possible to cover the entire subject in a paper of this character, I will limit my remarks to the experimental work we have attempted at the clinic in Pittsburgh.

In that we have had placed at our disposal a larger amount of radium element than possessed by any other individual, and because this work was under my direct supervision, I feel that I may speak with some authority on the subject. Furthermore, I have been in a position to become acquainted with the technic employed and dosage used by a majority of the men in England and in this country and this latter information has contributed not a little to my knowledge on the subject.

We have applied radium in quantities ranging from 4 to 1010 milligrams of radium element, the smallest dose in the treatment of a single case being about 30 milligram hours and the largest 65,000 milligram hours. The majority of cases received radiation from 10 to 250 milligrams of radium element the period of each application ranging from 15 minutes to 24 hours.

It is to be noted that I speak in terms of radium element, and not as some writers, in terms of radium bromide, or in terms of the supposed radioactivity of the salt used. I do this because it is only the radium element content of any salt that is therapeutic.

\*An address delivered October 12th, 1914, during the Annual Alumni Clinical Week of the College of Medicine of the University of Nebraska, at Omaha, Nebraska.

tically active and, therefore, is, as clearly pointed out by the International Committee on the Radium Standard, the only scientific method of stating dosage.

To illustrate: I have stated that the maximum dose employed was 1010 milligrams of radium element. I could just as easily have said that I used eighteen hundred and ninety milligrams of pure radium bromide, and it would have seemed to be a much large amount. The bromine in the radium bromide, however, is of no therapeutic value whatever.

Again I spoke of using four milligrams of radium element. This amount happened to be in such a form that I could, according to one terminology, state that the radium used was of two million activity and thus convey the idea that I have applied a large amount, when in reality my dose was sufficient only in the most trivial dermatological condition.

In the early days of the clinic, it was my inclination to accept only those cases considered beyond control by other measures. Perhaps I had better say that this condition was forced upon me for, naturally surgery—early surgery—held the field, and it was difficult to be convincing, especially in the face of the many conflicting opinions regarding the true value of radium. Many of the cases accepted had already had the the advantage of surgery, and “surgical failures” provided me with experience in dosage and technic which later proved of value where I could conscientiously recommend radium in preference to “questionable” surgery, with its resulting deforming scars.

When possible, it has also been my aim to ray cases not generally accepted as being suitable for radium. For instance, we have not attempted to do experimental raying with uterine fibroids or uterine hemorrhage, because this work has been so well carried out by a few foreign workers and by *Kelly* and *Burnam* in this country. It has only been recently that we have devoted much time to “superficial” work for I considered the work of *Wickham* and *Degrais, Abbe*, The London Radium Institute, and many others, as proving, beyond a question, the value of radium in such conditions. In consequence of this attitude, my results are not what I could have made them.

I trust you will observe also that I use the term “clinically cured”. I adopt this term in reporting cases wherein not enough time has elapsed before we can say that there will be no return of the condition. The London Radium Institute report such results as “improved”, and I consider this institution the best available authority.

I will quote, as briefly as possible, a few case histories, giving as much of the technic as necessary for a clear understanding. I have purposely selected the most difficult cases from each group.

CASE OF INOPERABLE CANCER OF THE UTERUS AND RECTUM IN A PATIENT 50 YEARS OF AGE.—Patient suffered for last five years

with profuse leukorrhea and in January, 1913, noticed a profuse bloody discharge from vagina. Discharge had disagreeable odor. Examined by gynaecologists and found inoperable. I examined her May 27, 1913, in conjunction with Dr. C—— and found ulceration over entire cervix and posterior cul-de-sac. Rectum involved. Indurated area extensive. Frequent hemorrhage. Foul discharge and intense pain. Vomiting and other symptoms of general infection. Because patient was the wife of a physician, the treatment was undertaken, it being understood that nothing but relief of pain could be expected.

Applied from 100 to 200 milligrams of radium element, screened with 3 mm. lead, silver and rubber. This was further screened with gauze and packed against the cervix and in the cul-de-sac. The individual treatments lasted from 14 to 18 hours. Applications made every three days. After six applications, two tubes of 50 milligrams radium element each were placed in the rectum and two in the posterior cul-de-sac, using cross fire method for 16 hours. This was repeated in two days.

After the first application, hemorrhage stopped and pain was relieved. After the fifth, the odor of the discharge had entirely disappeared. After the treatment to rectum, patient had normal bowel movements. After two weeks, patient was able to sit up and could retain food in stomach.

Although I was reluctant to take this patient, it taught me that radium is, perhaps, the best palliative agent to use in this utterly hopeless condition. To relieve the pain, to stop the hemorrhage, to clear up the odor,—is something, and to prolong life in comparative comfort is, I believe, something more.

In commenting on this case, Dr. C.—— says: "My opinion of the case of radium in this particular case is that it did all you promised for it, namely, that it stopped the hemorrhage and relieved the pain to some extent. Its influence upon the bleeding was absolute, she not having any hemorrhage from the time you began to use the radium. In the beginning there was a marked decrease in the amount of pain, but later on in the patient's illness it again recurred, although not to the same extent that existed before the radium was used. For a time her general condition was markedly improved, which lasted for a period of about three weeks, when she began to decline. I will add, too, that the ulceration which was present on the cervix uteri had practically disappeared under the influence of radium."

Patient died October 31, 1913,—157 days after treatment was started.

INOPERABLE CANCER OF THE UTERUS IN A PATIENT 61 YEARS OF AGE.

Past, personal and family history—negative.

About two months ago, noticed backache and pains in abdomen. At the same time noticed stain of blood on linen. No uter-

ine pain whatever. Date of admission to clinic—February 9, 1914.

Examination—uterus enlarged, hard, and tightly bound down. Entire cervix involved in ulceration. Vaginal mucosa considerably thickened. Muco-purulent discharge from cervix.

|                   |           |
|-------------------|-----------|
| Red cells .....   | 4,450,000 |
| White cells ..... | 9,960     |
| Hemoglobin .....  | 75%       |
| Polynuclear ..... | 75%       |

TREATMENT—February 10, 11 and 12—52 milligrams of radium element, screened with .5 mm. silver and 1 mm. lead and 1mm. rubber for three hours.

February 13 and 14—100 milligrams in vagina for five hours.

February 16 and 17—52 milligrams in cervix for two hours.

February 20, 21, 23 and 24—50 milligrams in cervix or vagina for two-hour periods.

February 26—92 milligrams in cervix for two hours.

NOTES—February 26—Patient had chill. Signs of septic absorption.

March 7—Cancerous tissue sloughing. Vaginal walls give evidence of burn.

March 20—Patient discharged from clinic. Temperature still elevated.

April 5—Family physician reports general condition not improved. Gradual failure with progressive weakness.

July 27—The following letter was received from the patient's daughter:

"At present time we have every hope of a recovery. Mother has complete control of all her faculties and you would never know she has been ill. For one month after she returned home from the Hospital, I employed a trained nurse. Since that time I have taken absolute charge of her, and she has been given morphine only five times, and then only one-third of a grain.

"For the first two months after she returned home we gave her a tablet for bowel movement, but for nearly ten weeks now the action has been perfectly natural, and she has been given no aid whatever. Her kidneys are in perfect action and her heart normal. She eats three good meals a day and the heat in no way affects her. While she does not sleep as well as I would like her to, still she does not feel any ill effect from that source. She has absolutely no pain whatever, and says she feels fine where the trouble existed. She is surely getting stronger and better, reads the daily papers and is keeping alert on current subjects. There is still a discharge but a very little, just enough to know it is there, but with very little odor.

"I hope you will not think me too elated and too over-confident, but when I see results I cannot help but express my appreciation to those who aided me. I cannot understand why the medical world will not open their eyes, when it has done what it

has, and I have had constantly before me one or two men who spoke in Memorial Hall at the Cancer Meeting, and I would love to retaliate. Even if it does not produce a cure, it has done wonders in my mother's case."

On October 1st, 1914, the following was received from her daughter:

"My mother has been quite well all summer, spending a greater part of her time on the porch. She has had absolutely no pain all summer, and had perfect bowel movement without medicine, every morning. There is a slight discharge of very light color, not to be compared with what it was before treatment."

This is a splendid example of the toxic condition which we sometimes encounter when raying extensive lesions in cavities that are subject to mixed infections. I noted this condition early, reported it, and adopted the following rules to overcome same.

1. Wherever possible, establish good drainage.
2. Best possible surgical cleanliness.
3. Stop raying before diseased tissue begins to slough and do not ray again until the condition of the underlying structure is noted.
4. Under no circumstances open up blood channels by rough manipulation, during or after raying, at least until reaction has entirely disappeared.

I am sure you will agree with me that these two cases demonstrated the value of radium in inoperable cases of cancer of the uterus, not as a cure, but as an agent that will more easily relieve distressing symptoms and make the last days of the victim tolerable. Up to the present time, I have never had a favorable uterine case submitted. By a favorable case I mean one that has progressed just a little beyond what the surgeons call "favorable". When I do, I will ray the local ulcerated area, wait until all reaction has subsided and then, if possible, I will operate, following by additional raying. If localized metastasis is present in accessible glands, I will give them a massive dose, remove, and immediately after operation ray the base of wound.

RECURRENT CANCER OF THE BREAST IN A PATIENT 52 YEARS OF AGE, OPERATED 14 YEARS AGO.—Recurrence standing for about a year. Examined on February 13, 1914, showing mass about the size of a hen's egg, situated to the right of the sternum. It is hard and immovable with a sinus in the center, which is the seat of considerable hemorrhage. Ulcerated surface extends for an area of a half inch around this sinus. There is considerable pain at times. Patient also presents an epithelioma about the size of a half dollar on the back of the right hand and one about the size of a dime on the back of the left hand.

TREATMENT.—50 milligrams of radium element, screened with .5 mm. lead and silver and .5 mm. of rubber, strapped in

place over the breast for 1 hour every day for 7 days.

Epithelioma on the right hand was rayed with 50 milligrams of radium element screened with 1 mm. of lead and 1 mm. rubber and placed over the area for 15 minutes on four occasions. Same procedure with epithelioma on the back of left hand.

February 28, 1914.—Mass less painful. Hemorrhage lessened and size of mass somewhat reduced.

March 10, 1914.—Condition on right hand is entirely well, with no resulting scar. It is practically impossible to tell the situation of the ulcerated surface. Mass in breast is less painful and still further reduced in size.

March 13 to April 13.—Patient has had treatments three times a week for one hour each time with 50 milligrams of radium element.

April 20, 1914.—Not much change in the condition of the patient's breast. Epithelioma on the right hand and the left hand marked "clinically cured".

June 10.—Pain in breast has all disappeared. No discharge. Mass reduced in size.

September 1.—Ulcerated surface around fistula covered with healthy skin tissue. Fistula closed. No discharge whatever. No pain and patient's general condition greatly improved. I have considered this a case of prophylactic raying only. From time to time I have caused a violent reaction and during this reaction discontinued treatment. On account of the absolute fixation of this mass to the underlying structure, the case was considered inoperable.

RECURRENT CANCER OF THE BREAST IN A PATIENT 77 YEARS OF AGE.—Four years ago, left breast was amputated and two and a half years later the growth reappeared at the site of the original growth. Second operation in December, 1912, removal of the recurrent growth and scraping of the bone.

About 10 months ago, had severe pain at the site of the operation and the growth returned. Removed under local anaesthesia. Pain at the same site was again manifest last October, six months ago, since when it has become more or less constant. Ulceration at the site of the growth for several months, which has been gradually enlarging and of late has been constantly discharging a seropurulent fluid.

A small tumor mass in the left parotid gland excised at the time of the first operation also returning. Left arm is swollen and its motion is limited since operation.

On admission April 27th, 1914, patient had discharging ulcer at about the center of the field of operation, about 4 x 5 centimeters square. The skin for some distance around the ulcer is very sensitive and the area of redness surrounding the border of the ulcer is about 1 centimeter in width. No section was taken for examination.

From April 28 to May 5th, inclusive.—50 milligrams of

radium element screened with silver tube and 1.5 mm. rubber, applied daily from 1 to 3 hours.

May 6, 7, 9 and 14.—100 milligrams with same screening applied for 3 hours at each treatment.

May 20.—Treatment discontinued, at which time the pain was greatly relieved and the ulcer looked cleaner and was beginning to fill in with healthy skin tissue.

June 2.—Patient re-admitted to the Hospital for further treatment. Ulcerated surface almost entirely covered over. Practically no pain has been felt since last treatment.

June 3, 4 and 6th.—50 milligrams, screened with 1 mm. lead and silver and .5 mm. rubber applied to ulcerated surface for 3 hours each day.

August 1 and October 10.—Reports from this patient states that she is still free from pain, and swelling in the arm is somewhat reduced. Ulcerated surface entirely covered.

My only idea in the treatment of this patient was to relieve only the pain, and I will say, that radium gave so much relief that she was able to give up the morphine which she was accustomed to taking.

**OSTEO-SARCOMA IN A MALE 55 YEARS OF AGE, LOCATED IN THE RIGHT BREAST.**—Two years ago, patient noticed lump in his right breast, which constantly grew larger. Reported to physician 10 months ago.

Received X-ray treatment for 4 months without any material change or apparent checking of the growth.

Upon examination the mass is about the size of a large orange. It is firmly attached to the ribs and overlying skin, with slight involvement of the axillary glands. It was decided to remove this mass and operation took place on April 7, 1914. As the mass was found to be firmly attached to the ribs and cartilage, it was impossible to remove all the diseased tissue.

Immediately following the operation, 210 milligrams of radium element were buried in the wound for 12 hours. On account of the poor surgical apposition of the skin, sloughing of the flaps took place.

April 27.—Patient discharged from the Hospital, presenting a large sloughing area, but much improved in general health.

July 10.—Visited patient at home and still found wound open, but no sign of recurrence.

September 10.—Patient reported, found a small mass about the size of a hen's egg on the border of the wound. This was cross-fired with 6 tubes containing 25 milligrams of radium element each, and the surgeon requested to remove the mass.

The present condition of the patient is not encouraging.

**ADENOCARCINOMA OF THE BREAST IN A PATIENT 73 YEARS OF AGE.**—Father and one brother died of cancer and one sister of

tuberculosis. About 6 years ago, she first noticed a small lump in the breast about the size of a beech nut. Began to enlarge after 4 years. About one year ago, ulceration began, at which time the severe pain continued and there was slight bleeding. Condition grew rapidly worse and the mass was about the size of an orange on the date of admission, February 22nd. Skin surface ulcerated and discharging a thin pus. Right and left axillary and left supra-clavicular glands enlarged.

Patient operated on February 26, outlying glands not excised. At the close of operation, 120 milligrams of radium element, screened with 2 mm. lead and rubber were buried in the center of the wound of operation for 8 hours.

February 27.—92 milligrams placed in the wound for 8 hours, screened as before.

March 14.—Treatment of glands was begun. 100 milligrams placed over the glands of the axillae and the clavicle for 1 hour at each point.

March 18.—Same treatment as on the 14th.

March 20, 21 and 23.—100 milligrams over various glands for 1 hour at each point.

March 24, 27 and 28.—109 milligrams over the glands for 2 hours at each point.

March 28.—Patient discharged from the Hospital much improved both in general and local conditions. Glands much reduced in size.

May 20.—Patient re-entered the Hospital and 100 milligrams of radium element was applied over the left axillary gland for 4 hours.

May 21.—Same treatment as previous day.

May 26.—Same treatment again.

NOTES.—April 6.—The wound of operation is entirely healed except at the site of the implantation of the radium. Supra-clavicular glands slightly palpable. Right and left axillary glands smaller and softer. General condition good.

April 20.—Skin over clavicular glands considerably burned. Surgeon in the case reports that when he last examined the patient two months after the treatment was discontinued, she was still in good condition.

July 1.—Surgeon reports that there is still no sign of recurrence and that the glands are greatly reduced in size.

INOPERABLE CANCER OF THE RIGHT BREAST AND OPERABLE CANCER OF THE LEFT BREAST IN THE SAME PATIENT, ALSO PRESENTING BILATERAL ENLARGEMENT OF THE THYROID GLAND.

In December, 1913, patient noticed a slight swelling in the right breast. This was reported to her physician in February, at which time the mass appeared to be freely movable and about the size of a marble.

Patient refused to have any interference whatever. Mass began to grow rapidly in size and at the time of admission to the

Hospital, August 22, ulcerated surface extended for 3½ inches around the nipple. Indurated area extended 2 inches around this, and the nipple was retracted and the mass fairly attached to the ribs. It is decidedly inoperable.

On August 22, 36 tubes of radium, amounting in all to 710 milligrams of radium element, were placed over the mass, the screening being 3 inches of felt and .5 mm. of silver.

310 milligrams of radium element were also applied over the enlarged thyroid gland. These were left in place for 8 hours. On September 2nd, 810 milligrams of radium element, arranged in the same manner as above, were placed over the breast for 9 hours.

September 26.—Patient re-entered the Hospital. Indurated mass was considerably lessened and extensive swelling in the glands and tissue of the axilla was greatly reduced. Ulcerated surface presented absolutely no sign of burn. The pain, which was formerly a prominent symptom, had completely disappeared.

The mass in the left breast was about the size of a hen's egg. It was cross-fired with 6 tubes of radium, each containing 25 milligrams of radium element, applied for 18 hours.

September 30.—This mass was removed and in the incision was buried 50 milligrams of radium element from 3:30 P. M. until 1 P. M. October 1st.

This case is cited to show the different methods of procedure in raying the inoperable breast by a massive dose and the operable breast by a combination of radium and surgery. It will certainly be interesting to watch the progress of this case.

From the above cases you will note how I have attempted to treat inoperable cancer of the breast. Where possible, surgery and radium were used in combination. At the present time, I think this is the proper method of treating all cases of cancer of the breast.

**CASE OF INOPERABLE CANCER OF THE TONSIL.**—Physician, 60 years of age, condition standing about 6 months. Reported at clinic October 25, 1913. General condition was bad. Could swallow liquids but with difficulty. Although patient was unable to open mouth for a good view of parts involved, it was ascertained that the entire right tonsil area and the right side of the tongue at base were involved. Patient stated that process had extended rapidly since tissue had been removed for diagnostic purposes. Glandular involvement extensive. Sanitary condition of mouth very bad. Had this patient been other than a physician, I would not have even considered an attempt to ray.

Gastrostomy advised for the purpose of feeding, but refused.

I considered that the only hope was short time periods of raying with massive doses. We could remove the upper incisors, which were on a movable bridge, thus making possible the placing of an application. Because of too much bulk, however, the radium tubes could not be sufficiently screened.

We applied about 100 milligrams of radium element every day for 1 to 2 hour periods, and rayed the glands for 4 hour periods with 200 milligrams of radium element. The procedure was carried out for 5 or 7 days. At the end of this time, patient seemed somewhat improved in that he could swallow better and even take a little solid food. He was able to wash out mouth frequently.

The reaction appeared a few days later and was, because of necessary heroic measures, violent. Gastrostomy was again urged and performed, two days later. To add to complications, the stomach wound became infected and at the patient's request he was sent home.

November 20th, the following was received from the patient's wife:

"While the Doctor seems somewhat weaker than when we left Pittsburgh, his condition seemingly is not considerably worse. The pulse is of fair quality and there is no temperature. He has retained nourishment (through tube). The mass under the right ear has decreased in size. The mouth is in bad condition and he is unable to swallow anything except ice water. At times he feels stronger and wants to go on with radium if you think advisable."

Nothing further was attempted, however, and the patient died about 10 days later.

Previous to seeming this case, I had noted other patients who gave a history wherein it was definitely stated that the condition grew rapidly worse after the removal of specimen for examination. I refer, of course, to suspicious lesions on mucous surfaces.

This was so noticeable in Dr. W——'s case that I took up the question with several noted surgeons. One of them told me that an attempt to remove even the smallest cancerous area of the tonsil always caused rapid infiltration into the surrounding glands and he had given up all operative procedures in this particular locality. This caused me to adopt the rule of not permitting specimens to be removed from suspicious lesions on mucous surfaces before treatment.

**CANCER OF THE TONSIL IN A FEMALE OF 67 YEARS OF AGE.**—Six years ago lump appeared on left side of face under ear. In last 2 months the mass grew from the size of an egg to that of a large orange. Admitted to Eye and Ear Hospital on March 18, 1913. Mass was removed, jugular vein tied off. Discharged April 15, with small discharging sinus.

Two months later was re-admitted to Hospital and sinus curetted. Wound eventually healed and patient suffered no discomfort for 6 months. Then pain in old scar with paralysis of cheek and tongue caused alarm. Again admitted to Hospital September 10th, 1913. Examination showed evidence in old scar of return of the growth, together with involvement of all surrounding glands. Left tonsil and small area on left side of tongue

involved and process evidently rapidly extending.

General condition of patient not good. Difficulty in opening mouth. Decided to push radium to limit and patient was advised to expect extensive burns.

Applied 100 milligrams, screened with 2 mm. silver, lead and rubber for 4 hours, daily for 7 days. Applied almost constantly for same period, 200 milligrams radium element, screened with 4 mm. of silver, lead and rubber, and gauze, to all surrounding glands. Patient then sent home. September 23rd, was advised that patient was in bad shape, burns of mouth were extensive and causing considerable discomfort and that she could live but a few days.

To my surprise, two months later, patient reported and on examination found condition in tonsil and on tongue had entirely cleared up. The enlargement in glands, with exception of small area below left ear, had disappeared and induration in old scar lessened. Advised to have further raying on enlargement near ear. She was given one or two applications at another institution. Six months later she still had some enlargement in this area and she reported to my clinic for additional raying. At this time her tongue and throat gave absolutely no evidence of return of the condition and the patient's general condition seemed greatly improved. She arrived at the Hospital at 10 A. M.

The next day at 1 P. M. she had a chill, developed pneumonia, and died two days later.

This incidental accident deprived me of what I was fully justified in considering a most remarkable clinical recovery. It also taught me that we are justified in pushing treatment even to the extent of severe burns in these desperate cases.

I realized that the possibility of increasing absorption from an already existing mixed infected area by producing burns was an element that must be given consideration. Radium is not, strictly speaking, a germicide; therefore, does not have much destructive powers to bacteria. The patient should, then, be given additional fighting ability by strict attention to general condition and by using every effort towards securing surgical cleanliness in the parts being rayed.

All my eye, ear, nose, mouth and throat cases are instructed to use mouth or eye wash, nasal douche, every hour during treatment and until burns are healed.

Speaking of radium burns: This patient was, to me, an ideal demonstration of the difference between the X-ray and the radium burn. In the tense tissue of the old scar I produced extensive burn. At the end of two months, scarcely any evidence of same remained.

CANCER OF TONSIL IN FEMALE 76 YEARS OF AGE.—Had trouble with her throat for several months. Tonsilectomy performed a few weeks ago. Examination of removed tonsil showed it to be

carcinomatous. Seemed to be recurring as ulcer appeared again at base. Admitted to clinic July 14th.

TREATMENT.—July 14 to July 23rd.—Daily treatment for 1 hour each day with 50 milligrams radium element, screened with  $2\frac{1}{2}$  mm. of lead, silver and rubber.

July 20.—50 micrograms of radium element as soluble salt in normal salt solution injected into the vein. This because of its tonic effect.

July 23.—Patient sent home until reaction was over.

August 18 to 22.—Daily application of 50 milligrams of radium element, screened with .5 mm. silver and rubber tissue.

August 22.—Patient again sent home.

September 25.—Case reported before the Medical Society of the State of Pennsylvania by operating surgeon. Said to give every evidence of a clinical cure.

In connection with cancer of the tonsil, wish to state that Dr. *Hill* of London reports unusual success with radium in this condition. At the last meeting of the British Medical Association at Aberdeen, Scotland, Dr. *Hill* stated in his address that operation for cancer on mucous surfaces should be discontinued and radium substituted.

CANCER OF TONGUE IN MALE 46 YEARS OF AGE.—About 6 months ago, broke a tooth. It irritated tongue and tooth was removed 4 months later. At this time dentist noticed tumor on tongue.

On March 1, 1914, and on May 1, exposure to massive doses of X-ray. Entered clinic June 1, 1914. Examination showed ulcerated area near base of tongue on right side, oval shape, smooth, with inflamed edges. Articulation not distinct.

June 2 to June 12th.—50 milligrams of radium element screened with 0.5 mm. silver, 0.5 mm. lead and 0.5 mm. rubber daily for 1 to 3 hours. After the third application, relief from pain was quite marked.

June 12.—Patient discharged. Ulcer appeared cleaner and reduced in size. Reaction very severe.

September 12.—Received report from attending physician, stating that patient seemed to improve for a time, after which the process extended very rapidly and the patient died.

CANCER OF TONGUE IN MALE AGED 61.—Ten years ago, noticed slight sore spot on left side of tongue, which was relieved by mouth wash. Did not bother him again until 1913, at which time it was not relieved as previously and continued to enlarge until it measured  $\frac{5}{8}$  x  $\frac{3}{8}$  inches.

Began X-ray treatment, but discontinued same until about 3 weeks ago, when he received a few more treatments. On admission to clinic March 3rd, two-thirds of the lateral surface of tongue was involved. Considerable sloughing had taken place, leaving a large cavity.

TREATMENT.—March 5th.—Wasserman reaction—positive. As patient had never received any constitutional treatment of any description, was placed on same at once.

March 5 to 10th.—92 milligrams radium element, screened with 1 mm. lead and 1 mm. of rubber applied for 1 hour.

March 6th.—Given intravenous injection of 50 micrograms radium element.

March 28 to April 10.—Received 13 applications of 109 milligrams radium element for 1 hour each time.

April 14.—Intravenous injection of salvarsan.

April 20.—Tongue lesion partly healed. Left tonsil enlarged.

May 5.—Tongue lesion still partly healed. Buccal mucous membranes almost healed. Gums still swollen and tender. Can only open mouth about two finger breadths. Mental attitude very bad. Pain in parotid glands severe.

July 6.—Patient in bad condition. Original lesion on tongue somewhat improved, but process evidently extending over base of tongue and tonsils.

Both these tongue cases improved somewhat at first but could not be held. This experience was noted at the London Radium Institute. Recently, however, they are having better success by stitching the tubes into place.

Dr. Bissell of New York also reports a case clinically cured after 6 months by this method of treatment.

I will adopt this method where possible, as it is extremely difficult to hold applicators in place, consequently, additional irritation is set up.

It is also noted that these cases were first treated by X-ray. In using radium after X-ray, I invariably find a condition that is called radio-sensitive. In other words, we are liable to set up pain in the parts being rayed. Just why this is, I am not able to state, but it has frequently obliged me to cut down the dosage. Naturally, I prefer not to ray a case after X-ray has been used.

MELANOTIC SARCOMA OF THE EYE IN A MAN 45 YEARS OF AGE.—Operated twice with rapid recurrence each time. When examined found recurred mass which entirely filled up cavity. Incision made into mass and a 50 milligram tube screened with  $2\frac{1}{2}$  mm. of lead and rubber buried for 12 hours. After reaction had subsided, mass was removed and same tube was buried in cavity for 12 hours. This patient was presented at the recent meeting of the Medical Society of the State of Pennsylvania, 6 months after treatment, and there is no sign of recurrence.

MELANOTIC SARCOMA IN A MAN AGED 55 YEARS.—Same procedure as in previous case. This patient was also presented at the Pennsylvania Medical Society Meeting, and 5 months after treatment, shows wound healthy, with no sign of recurrence.

MELANOTIC SARCOMA IN A MAN AGED 68.—Two years ago, noticed small spot on sclera of left eye. Eye soon became swollen

and painful. Operated December, 1913. Uneventful recovery.

Six weeks later small growth was removed from left cheek. Patient began to wear artificial eye two weeks after operation. Nine weeks after operation, began to recur. Later the mass in the cheek began to recur. Had X-ray treatment for 2 or 3 weeks.

On admission to clinic, May 5, 1914, found left orbit entirely filled with dark reddish-black soft mass.

May 5.—Same method employed as in previous cases.

May 11.—Mass removed and 100 milligrams placed in cavity for 6 hours.

May 19.—200 milligrams applied to cavity for 5 hours.

June 11.—Consistent improvement, but swelling in left parotid shows signs of enlargement.

July 21.—Patient re-admitted for operation on mass in left parotid gland, but was not rayed.

August 14.—Mass returning in parotid gland. Rayed with 50 milligrams.

August 17, 19 and 20.—Same treatment as August 14th.

August 29.—All inflammatory reaction subsided. Mass in gland reduced in size. Still small nodule in scar of old operation. Applied 100 milligrams for 2 hours over these points.

September 15.—Patient presented good appearance. Do not expect, however, to hold this case as the involved tissue is too extensive.

**OSTEO-SARCOMA IN A MAN 50 YEARS OF AGE.**—Location on left of spine in gluteal region. First noticed in 1912, operated on March 23rd, 1913. Recurred rapidly and operated again June 3, 1913. This time wound was left open and X-ray used. Again rapidly recurred and when examined found mass size of orange which had pushed aside incision and was bare of skin. Given radiation, using cross-fire method from 2 twenty milligram varnish applicators, strapped in place and applied all night, until mass had completely flattened out.

Was then sent to Hospital and deorganized mass lifted out. The entire base of wound was then thoroughly rayed.

On October 1, 1913, there seemed to be a little suspicious spot in upper margin of wound. This was incised and 150 milligrams, well screened, was buried for 20 hours.

On October 1, 1914, the wound is still open, gradually filling in. There is absolutely no sign of recurrence and it is gradually filling with healthy granulation tissue.

While using the X-ray he was severely burned on opposite side and this burn is still not entirely healed.

He also received a severe burn from the 150 milligrams of radium element, and this is almost, if not entirely, healed up.

Altogether this man received 65,000 milligram hours of radium, by far the largest recorded accumulative dose ever administered.

**OSTEO-SARCOMA IN A MAN 35 YEARS OF AGE.**—Twelve years ago had left lateral upper incisor extracted, piece of root remaining. Gave trouble at intervals. July 10, 1913, piece of root sloughed through gums and was removed by dentist. A week later noticed on either side soreness and looseness.

August 5th.—Operation, with extensive curretting. Parts began to swell two weeks after operation.

From last of August to December 27, X-ray used almost daily and pushed to point of superficial burn.

Entered Radium clinic December 29th. Mass involved left superior maxillary bone, bulging out cheek considerably. Process extended over left side of palate, involving lower plate of orbit and left superior alveolar process and glands of neck. Large opening into antrum.

January 3, 1914, to February 12.—Treatment almost daily, with from 50 to 150 milligrams of radium element applied from 2 to 5½ hours and exposing all accessible parts of growth and glands.

From this time until March 26th, various amounts up to 200 milligrams were applied at intervals, using the cross-fire method, one tube being placed in nose, two tubes in the mouth, one in antrum and the balance applied externally.

At times there was improvement but at no time was the process under control.

Patient died April 18th, 1914.

My experience in this case, together with three others of almost a similar nature, compared with results obtained in a number of beginning cases, has demonstrated the folly of attempting to ray cases wherein we find extensive destruction of the periosteum. I have also noticed in raying rodent ulcers that this is a good rule to follow.

**CASE OF OSTEO-SARCOMA OF THE KNEE IN A MALE 63 YEARS OF AGE.**—This case is interesting in that it demonstrated the effect of radium on ulcerated surfaces as compared with surgery, X-ray and carbon dioxide snow.

Four years ago, patient noticed small nodule on outer surface of knee. Two years ago, it had grown to be the size of a man's fist. Removed by operation in December, 1911.

Developed erysipelas following operation. Two other tumors developed in old scar, which were removed in March, 1912, after which he had X-ray treatment for three months.

Recurrence in June, 1912, operated again in December, 1913, followed by X-ray.

Two days before entering clinic, a large round nodule above ulcerated surface was treated with carbon dioxide snow.

Examination February 9, 1914, showed a large circular discharging ulcer about 3½ x 4½ inches. This area had numerous elevated masses scattered over the surface.

I realized, because of the deep-seated infection, and the extensive involvement of bone that operation was the only course. I, therefore, decided to ray as a prophylactic measure, and I submit a picture of case showing the superficial area that was already under control when I turned the case over to the surgeon for amputation.

The pathology of this case is also very interesting:

"In the center of the wound section shows degenerated material with cell nuclei barely visible, and outline of tumor cells lost. Considerable increase of fibrous tissue is present. At margin there are places where cells are clearly defined,—spindle shape in form and stain deeply. There is this also in some of the deeper portions of the tissue and here mitotic figures are common. The periosteum is involved and although the shaft is thin, there is an increase of fat in the medullary portion. The muscle cells are mostly degenerated, but in places their nuclei have increased in large numbers, even forming giant cells."

**CANCER OF RECTUM IN MALE 50 YEARS OF AGE.**—Noticed swelling in rectum two and a half months ago. Had cramps and painful passages for past two months. Operated April 22, complete removal of rectum and cancerous mass. Gut amputated with cautery and sacral anus constructed. Evidence of return at this point.

May 6.—50 milligrams radium element buried in new rectum for 8 hours and 50 in wound sinus just anterior to new rectum.

May 10.—100 milligrams inside new rectum for 1 hour and 50 in wound sinus for 4 hours.

May 20.—All treatment discontinued on account of temperature elevation and purulent discharge from wound.

June 20.—Patient at home and apparently quite well.

**CANCER OF RECTUM IN FEMALE 30 YEARS OF AGE.**—Operation for hemorrhoids, but operation abandoned when nature and extent of disease discovered. When patient came to clinic, she presented all symptoms of general absorption and local condition had extended until it involved tissue about 6 inches in extent. Pain was intense.

She was rayed with 100 milligrams radium element, well screened, the tube being placed in catheter and moved to various locations of mass and retained in place as long as could be tolerated. Pain was relieved and growth apparently checked.

This patient should have had false rectum established but she was in no condition to stand operation. She lived about 2 months after being sent home and the only thing accomplished was relief of pain with more comfort in defecation.

**CANCER OF RECTUM IN A FEMALE 55 YEARS OF AGE.**—Condition discovered at time of operation to relieve fissure. Small piece of tissue removed and found to be cancer. Was sent to clinic about 10 days after operation. This was a good case to ray, as wound was left open.

The case was given 5 applications, using 50 milligrams in sinus and 50 milligrams in rectum. One year after raying there is no sign of return and patient is in excellent health.

I believe radium will prove of considerable benefit in cancer of the rectum, if cases are taken early. In extensive cases or in cases where it is necessary to ray extensively it is, in my opinion, necessary to make false anus, so as to prevent irritation and possibly a mixed infection by having stools pass over part being rayed.

**CANCER OF THE STOMACH IN A MALE ABOUT 50 YEARS OF AGE.**—This is a case of experimental raying in a hopeless case to develop technic.

We passed a tube of 100 milligrams of radium element through a gastroscope and held it in place for 30 minutes, position of tube being ascertained by quick exposure to X-ray.

The patient experienced no bad symptoms following.

Because of short application, difficulty in ascertaining exact spot to be rayed, and the necessity of an anaesthetic every time applied, this method cannot be used.

The only feasible method is by making gastric fistula.

**CANCER OF OESOPHAGUS.**—Three cases were treated by one of my medical friends. All cases were desperate. The radium was passed with aid of oesophageal scope and no difficulty is experienced in hands of experts. Position of tubes is ascertained by X-ray picture.

Tube of 50 and 100 milligrams of radium element used. This tube is made of gold, over which hard rubber is brazed. Marked improvement, for a time, was noticed in all cases.

In one case, the improvement lasted for about 5 months.

I believe that favorable cases of cancer of the oesophagus will be controlled with proper dosage and expert technic.

**CARCINOMA OF ALVEOLAR PROCESS IN FEMALE 41 YEARS OF AGE.**—Patient first noticed small mass just above the upper incisor teeth. Dentist treated it with acid. Reported to physician after 3 weeks and it was removed and examined. In two months it returned and grew rapidly. No pain or discomfort.

Reported to clinic March 1st, 1914, ulcerated surface about the size of a dime, surrounding tissue indurated.

March 1 to June 11.—Short applications, not exceeding 30 minutes, with 50 milligrams of radium element.

October 1st.—Patient examined, and there is absolutely no sign of the disease. It is hardly possible to determine the infected area.

What would surgery accomplish in this case? What would the patient look like if the usual proper surgical measures had been carried out?

**MYXO-SARCOMA IN A MAN AGED 62.**—For the past two months noticed sore spot on upper jaw, getting progressively worse. Examination showed rounded mass over last molar, about the size of a penny.

Operation June 18th, unerupted tooth found and extracted. Alveolar process and part of jaw bone curretted.

June 19th.—Embedded 50 milligrams of radium element, screened with  $\frac{1}{2}$  mm. silver,  $\frac{1}{2}$  mm. of lead and 1 mm. of rubber for 5 hours.

July 1.—Wound entirely healed. No evidence of disease in tissue.

CANCER OF LIVER AND GALL BLADDER IN PATIENT 70 YEARS OF AGE.—Operation 4 years ago, and small stone removed from gall bladder. Operated again April 28th, 1914. Surgeon discovered pea-sized nodules on under surface of liver and gall bladder. These were found to be carcinoma.

May 7.—100 milligrams, screened with  $\frac{1}{2}$  mm. silver, 1 mm. of lead and  $\frac{1}{2}$  mm. rubber buried in wound after removal of drainage tube for 12 hours.

May 8.—Same treatment.

May 15.—Same treatment.

May 30.—Physician reports that patient is at home and in excellent health.

September 3.—Patient died with symptoms of general absorption, as reported by attending physician.

CARCINOMA (BASOCELLULAR TYPE) IN WOMAN 68 YEARS OF AGE.—There has been a small growth in left eyebrow for four years. Gradual increase in size.

Examination shows tumor mass on outer supra-orbital ridge, irregular outline and nodular. Growth of same character on middle portion of nose and small spot on tip of nose.

March 2, 1914.—50 milligrams screened with 0.5 mm. lead, 0.5 mm. silver and rubber, placed for half hour, on each spot.

Repeated at frequent intervals until April 6th.

April 20th.—Patient discharged as clinically cured.

September 1st.—No sign of recurrence.

EPITHELIOMA (RODENT ULCER TYPE) OF LOWER LEFT EYE LID, IN A MAN 38 YEARS OLD.—April 20.—25 milligrams, screened with 2 mm. lead and rubber, applied for 1 hour.

April 29.—Same treatment.

May 18.—50 milligrams radium element applied for 20 minutes.

September 24.—No sign of recurrence and scar scarcely visible.

EPITHELIOMA OF THE LIP IN A MAN 45 YEARS OF AGE.—Ulcerated surface about the size of dime, standing for 8 months or so. Recently extending rapidly.

Applied 50 milligrams of radium element every other day for four treatments.

Six months after treatment was discontinued, no sign of ulceration is present. Induration all disappeared and flexibility restored. Scar scarcely noticeable.

During the past two years, I have had many such skin and mucous membrane lesions as the above referred to me. Some of them minus a lip or part of the nose and all recurring. Surgery plus deforming scars almost as unsightly as the original growth and recurrence.

Compare these results with many that I have treated and many more that I have seen treated with radium. Suppose you yourself had to be treated. Which method would you select?

In my immediate family, a patient developed a rapidly growing epithelioma on the right hand. He does not have it today, but he does have all his hand.

**LARGE PIGMENTED NAEVUS IN A CHILD AGED 1 YEAR.**—Circular in contour, embracing cheek, ear, scalp and neck, slightly elevated throughout, black in color and covered with dense growth of soft hair.

Six applications of 50 milligrams of radium element, screened with 0.5 mm. silver and rubber screening, applied at 15 different points for 5 minutes at each point.

Four applications of same applied from 5 to 15 minutes at various points.

July 5.—Inflammatory reaction over entire area began and was very severe.

July 27.—Inflammatory reaction subsided.

August 13.—Fully recovered from burn.

At several points the pigmentation is entirely removed.

Entire surface more normal in appearance and free from growth of hair.

This is the worst type of cases of this character but I think by careful work we can remove a large part of the growth.

**PIGMENTED NAEVUS IN A GIRL OF 18 YEARS.**—Situating on left forearm. Size of silver dollar. Considerably elevated. Black in color and covered with long hair.

Application of 10 milligrams of radium element in the form of a varnish applicator bare, every day for a total of 84 minutes.

After this series of raying there was a reaction.

Later rayed with 10 milligrams radium element in a varnish applicator for a total period of 60 minutes.

Shortly after, entire formation dropped off, leaving smooth skin surface of slightly reddish appearance.

This surface will be rayed to remove skin pigment still remaining.

The ordinary birth-mark, mole, wart, etc., yields readily to radium. Angiomas are easily controlled and the cosmetic results are remarkable.

In the treatment of local lesions of chronic eczema, radium does prompt work. In one extensive case of psoriasis, an ointment containing 200 micrograms of radium element to the ounce of ointment material, produced prompt results. The condition returned, however, about 6 months later.

The technic of radium application is not difficult. Each case, however, must be considered by itself and the dosage adapted to suit the case and not, as many do, try to adapt the case to the dose.

I believe that the first effect of the rays is upon the vessel walls. Too small a dose will stimulate circulation and increase cell resistance. Therefore, failure with possible stimulation of the growth is noted by men who possess inadequate amounts for the special case they attempted to treat. Shut off your blood supply, then your cell protoplasm will the more readily be destroyed and finally the rays effect the nuclei and you control the situation.

It is unfortunate that premature announcements were made regarding the value of radium, because it held back the true investigator. Results are sometimes startling but it is the "why" and "wherefore" that must be known.

The physics, chemistry and therapy of radium is developing rapidly and in two years has made great strides. During the next year, much more will develop for, generally, it is in the hands of good clinical men, research workers and universities.

Radium can be accurately measured, consequently, we know the dosage used,—the best formation for good work. We know how to screen, to cut off the various rays,—another point gained. I have shown you some of its penetrating powers and you yourself can judge of its value in this direction.

Being purely local in effect, it cannot hope to cope with general metastasis. So the radiologist, like the surgeon, says, *Send your cases early.*

I wish to say that radium workers have absolutely no excuse for ignorance as to the amount of radium element they possess. The time for saying I treated this patient with radium has gone by. What I *must* say is that I used so many milligrams of radium element, screened in such and such a manner, for a certain length of time, for so many applications.

In conclusion :

Radium has an advantage over other physical or mechanical agents, because it is more easily controlled and handled. In that there is absolutely no upkeep to radium and the fact that it can be used 24 hours a day for years and years, makes it, in reality, more economical to use. It is safe both for the operator and the patient, is applied without pain or the necessity of an anaesthetic and, when a result is secured, it has enabled the patient to preserve much healthy tissue that would otherwise have to be sacrificed by surgery.

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